

The Origins of Magnetic Structure in the Corona and Wind

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One of the most important and most puzzling features of the coronal magnetic field is that it appears to have smooth magnetic structure with little evidence for non-potentiality except at two special locations: photospheric polarity inversions lines, (non-potentiality observed as a filament channel) and coronal hole boundaries, (observed as the slow solar wind). This characteristic feature of the closed-field corona is highly unexpected given that its magnetic field is continuously tangled by photospheric motions. Although reconnection can eliminate some of the injected structure, it cannot destroy the helicity, which should build up to produce observable complexity. I propose that an inverse cascade process transports the injected helicity from the interior of closed flux regions to their boundaries, inversion lines and coronal holes, creating both filament channels and the slow wind. We describe how the helicity is injected and transported and calculate the relevant rates. I argue that one process, helicity transport, can explain both the observed lack and presence of structure in the coronal magnetic field.

This work has been supported by the NASA HTP, SR&T, and LWS programs.